Determinants of Port Performance: A PRISMA Approach

Buyung Pramitra[1], Mochammad Al Musadieq[2], Tri Wulida Afrianty[3], Teuku Noerman[4]
{buyungp.ub@gmail.com[1], musadieqfia@ub.ac.id[2], twulidafia@ub.ac.id[3], tnoerman@ub.ac.id[3]}

Universitas Brawijaya, Indonesia [1,2,3,4]

Abstract. This study examines key determinants influencing port performance. A systematic literature review was conducted, synthesizing insights from 22 journal articles, following PRISMA guidelines to ensure a comprehensive, evidence-based approach. The findings reveal that Networking Capability and Cost Leadership significantly enhance operational efficiency and market positioning, while Flexibility and Transformational Organization foster adaptability in dynamic markets. Digital Adoption and Ethical Leadership were also found to be crucial, with digital tools and ethical practices bolstering sustainability and trust. Collectively, these determinants underscore the multifaceted nature of port performance and emphasize the need for integrated strategies in port management. This research provides valuable insights for policymakers and port authorities in optimizing operational outcomes.

Keywords: Port Performance; PRISMA, Determinant Factors; Operational Efficiency; Digital Adoption

1 Introduction

The port industry plays a strategic role in supporting international trade, serving as critical hubs in the global supply chain that enable the movement of goods across nations. In this context, port performance is crucial, as optimized performance not only enhances operational efficiency but also directly impacts the port's competitiveness in the global market. Ports that can maximize performance contribute significantly to national economies by facilitating trade and reinforcing a country's position in global commerce. However, a comprehensive understanding of the specific factors influencing port performance is still lacking, particularly for ports in Indonesia that face challenges related to infrastructure, regulatory demands, and sustainability expectations [1].

Globally, ports are under increasing pressure to meet high sustainability standards, including energy efficiency and environmental management practices. International ports must now consider the environmental impact of their operations, including carbon emissions and hazardous waste management. Various regulations, including those in Indonesia, require ports to adopt environmentally friendly technologies and sustainable practices aligned with regulations such as hazardous waste and carbon emission management under the Ministry of Environment and Forestry Regulation. Meeting these standards is not only essential for continued port operations but also affects the port's reputation and competitiveness in an increasingly sustainability-conscious global market.

Despite these regulatory pressures, the specific factors significantly affecting port performance remain underexplored. Indonesian ports face unique challenges such as aging

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infrastructure and uneven technology adoption, which often hinder efforts to enhance operational efficiency. These challenges are compounded by limited investment in advanced, sustainable technology and infrastructure, which ultimately increases operational costs and reduces overall efficiency [2]. On the other hand, international clients' demands and regulatory compliance requirements compel Indonesian ports to adapt swiftly to remain relevant and competitive.

A systematic literature review using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) method can serve as a valuable approach to identifying key determinants of port performance. PRISMA offers a structured and transparent framework for screening and evaluating relevant literature, allowing for a comprehensive identification of critical factors influencing port performance based on prior studies. Through the PRISMA approach, this research will screen and analyze findings from various studies to uncover patterns, themes, and key determinants that impact port performance.

The PRISMA approach is especially beneficial as it provides a solid scientific basis for identifying factors that may not be apparent in individual studies but emerge as consistent patterns across multiple studies. This method will facilitate a systematic analysis of factors such as Networking Capability, operational flexibility, digital adoption, and other sustainability factors that may play an essential role in improving port performance. Thus, this approach is expected to provide a more structured and in-depth perspective on the key determinants of port performance.

In the Indonesian port context, the findings of this study will serve as a foundation for developing more targeted operational strategies. Indonesian ports currently face considerable challenges in terms of sustainability and efficiency, often lagging behind international standards. Identifying the specific determinants relevant to the domestic context can help policymakers and port managers formulate strategies that are responsive to global demands. A deeper understanding of these factors may also open opportunities for strategic partnerships, enabling ports to adapt more flexibly to the rapidly changing market and regulatory landscape.

This study is also expected to contribute significantly to the academic literature on port performance by offering an evidence-based perspective on the determinants of port performance. By identifying various factors from relevant literature, this research will provide a roadmap for future studies, allowing for deeper exploration of these determinants in more diverse contexts. Additionally, the results of this study will be valuable to industry practitioners and stakeholders in the port sector, providing them with a more nuanced understanding of both the challenges and opportunities associated with enhancing competitiveness through various performance improvement strategies. This study aims to develop a comprehensive understanding of the primary determinants of port performance using the PRISMA method. Through this approach, the study is anticipated to offer practical insights for the port industry in achieving higher operational efficiency and strengthening competitiveness in the global market.

2 Research Method

In May 2021, a Systematic Literature Review (SLR) was conducted in line with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. As described by [3], this method encompasses several key stages: (1) defining eligibility criteria, (2) identifying information sources, (3) selecting studies, (4) establishing the data collection process, (5) specifying data elements, and (6) confirming eligibility criteria.

This review was conducted efficiently, with the following inclusion criteria (IC) applied:

- IC1: Only original, peer-reviewed studies published in English were included.

- IC2: Studies needed to examine variables that influence port performance specifically.
- IC3: Research employing quantitative or mixed methods (incorporating both qualitative and quantitative approaches) was included.

The first criterion (IC1) restricted the studies to English for broader international accessibility, given English's role as a global language. The second criterion (IC2) required studies to address port performance, defined as the factors and metrics contributing to the operational efficiency and effectiveness of ports. Finally, the third criterion (IC3) emphasized articles utilizing quantitative or mixed methods, as these approaches support structured analysis through statistical and scientific methods, aligning with readers' expectations. Studies that exclusively used qualitative methods were not included in this review.

Information Source

The information search was conducted using an online database with extensive academic research repositories, specifically Elsevier (SCOPUS), which contains over 558 articles related to port performance. Articles that were not fully accessible were excluded from this study.

Study Selection

The study selection process was conducted in three distinct stages, as outlined below:

1. Performing searches with specific keywords aligned with the research objectives, focusing on factors affecting port performance, or using related terms frequently seen in this context: "(Factor OR challenge OR motivation OR driver OR drive factor OR critical factor OR critical success factor OR success factor OR key factor OR CSF OR determinant) AND (port performance OR port efficiency OR port productivity OR port effectiveness OR port success)".
2. Screening and selecting articles based on titles, abstracts, and keywords while applying the eligibility criteria.
3. Carefully reviewing and selecting all articles that were not excluded in the previous steps by thoroughly reading each one to ensure they met the eligibility requirements.

Data Collection Process

Data extraction was performed manually using content analysis-based methods, covering several key aspects, including article type, journal name, publication year, subject focus, title, research methodology, study participants or data sources, research location, variables related to determinants of port performance, indicators of port performance, and research findings regarding the impact of determinant variables on port performance.

Data Items

The extracted data from each article were organized into the following categories: publication year, authors, study country and sample, research objectives, research variables, determinants of port performance, and research findings on the impact of determinant variables on port performance. A detailed overview of the systematic literature review process is shown in Figure 1.

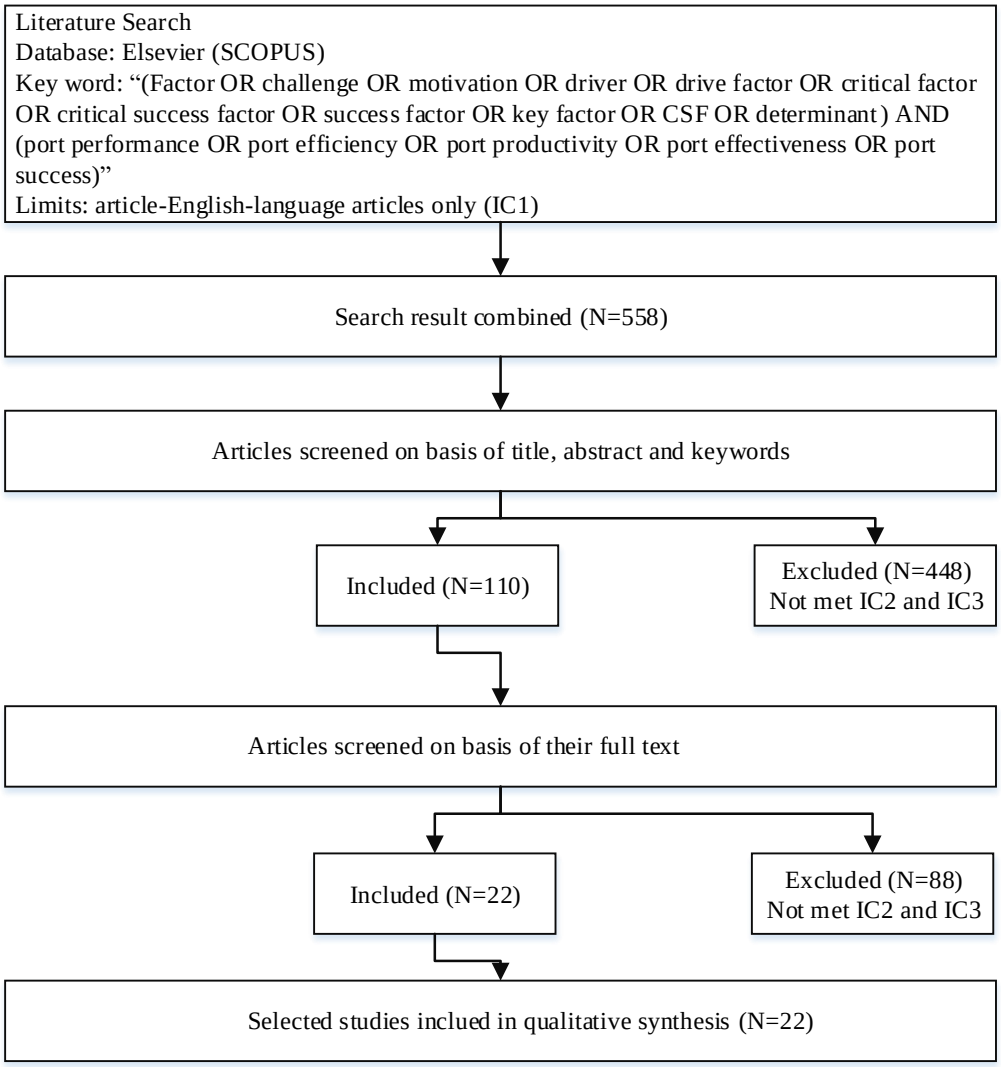

Figure 1. PRISMA flow diagram

3 Research Results and Qualitative Synthesis

A qualitative synthesis was conducted on the 22 chosen articles, as depicted in Table 1.

Table 1. Qualitative Synthesis Result

No.	Year	Author	Title	Country & Sample	Purpose
1	2021	Astri Ayu Purwati, Budiyanto, Suhermin, Muhammad Luthfi Hamzah	The effect of innovation capability on business performance: The role of social capital and entrepreneurial leadership on SMEs in Indonesia	Indonesia, 352 SMEs (Pekanbaru)	To explore how innovation capabilities impact SME performance in Indonesia, mediated by social capital and entrepreneurial leadership.
2	2020	Peter Gahan, Max Theilacker, Mladen Adamovic, Daejeong Choi, Bill Harley, Joshua Healy, Jesse E. Olsen	Between fit and flexibility? The benefits of high-performance work practices and leadership capability for innovation outcomes	Australia, Various industry data	To investigate how high-performance work practices and leadership capabilities contribute to innovation through organizational capabilities in different environmental conditions.
3	2020	Chijioke Nwachukwu, Hieu Minh Vu	Strategic flexibility, strategic leadership and business sustainability nexus	Nigeria, Microfinance Banks (Emerging Market)	To examine the influence of strategic flexibility and strategic leadership on business sustainability in emerging markets.
4	2021	Hans Harischandra Tanuraharjo	The Effects of Government Regulation and Distinctive Capability on the Cost Leadership Strategy to Drive the Business Performance of Minimarket Chain	Indonesia, Minimarket Chains	To analyze the impact of government regulation and distinctive capabilities on cost leadership strategy and its implications for the performance of minimarket chains.
5	2022	Ervina Waty, Idris	Networking Capabilities and	Indonesia, 100 Culinary SMEs	To examine the effects of

No.	Year	Author	Title	Country & Sample	Purpose
		Gautama So, Richardus Eko Indrajit, Sri Bramantoro Abdinagoro	Digital Adoption of Business Agility: The Mediating Role of Business Model Innovation		networking capabilities and digital adoption on business agility, with business model innovation as a mediator.
6	2024	Hussam Al Halbusi, Homoud Alhaidan, Fadi Abdelfattah, T. Ramayah, Jun-Hwa Cheah	Exploring Social Media Adoption in SMEs in Iraq: The Role of Social Media Network Capability and Customer Involvement	Iraq, 253 SMEs	To investigate how social media network capability and customer involvement enhance the impact of social media adoption on SME performance.
7	2021	Vikas Rai Bhatnagar	Employing Local Systemic Intervention for Evolving a Transformational Organization Strategy-Action Research in an Indian Business School	India, Business School	To explore the use of local systemic intervention for addressing chronic dysfunction and improving the viability of a business school in India.
8	2024	Elijah Gichuru Muiruri, Rayviscic Mutinda Ndivo, Joseph Njoroge Muiruri	Adoption of Digital Technologies as a Driver for Cost Leadership Strategy in Tour Firms within Nairobi City County, Kenya	Kenya, 278 Tour Firms	To assess the impact of digital technologies on cost leadership strategy, focusing on mobile applications in the tourism sector in Nairobi City County.
9	2023	Nadia Zahoor, Yong Kyu Lew	Enhancing international marketing capability and export performance of emerging market SMEs in crises	Pakistan, 129 ESMEs	To examine the effect of strategic flexibility and digital technologies on export performance in times of crisis, with international marketing capability as a mediator.

No.	Year	Author	Title	Country & Sample	Purpose
10	2022	Aldijana Bunjak, Heike Bruch, Matej Černe	Context is key: The joint roles of transformational and shared leadership and management innovation in predicting IT adoption	Germany, 5,884 employees and 92 leaders	To explore how transformational and shared leadership, along with management innovation, impact employee IT innovation adoption within SMEs.
11	2022	Corin Kraft, Johan P. Lindeque, Marc K. Peter	The digital transformation of Swiss SMEs: Insights from digital tool adoption	Switzerland, 1,593 SME managers	To analyze Swiss SME managers' perspectives on digital transformation, focusing on the adoption of digital tools in managerial and operational roles.
12	2023	Michael Sony, Jiju Antony, Olivia McDermott	How do the technological capability and strategic flexibility of an organization impact its successful implementation of Industry 4.0?	Europe and North America, 34 senior managers	To investigate how organizational technological capability and strategic flexibility influence the successful implementation of Industry 4.0, particularly in manufacturing and service enterprises.
13	2024	Masooma Zahra, Syed Asif Ali Naqvi, Sofia Anwar, Muhammad Sohail Amjad Makhdum, Bilal Hussain	Exploring the Drivers of Digital Transformation and Their Impacts on Adoption	Pakistan, 124 industrial stakeholders	To analyze economic, environmental, social, and organizational drivers of digital transformation and their effects on digital technology adoption in Pakistan's textile industry.
14	2024	Bora Ly	The Interplay of Digital Transformational	Cambodia, 388 respondents	To investigate the role of digital transformational

No.	Year	Author	Title	Country & Sample	Purpose
			Leadership, Organizational Agility, and Digital Transformation		leadership on digital transformation, with organizational agility as a mediating variable.
15	2021	Joan Nyambura Gitau, Robert Mang'ana	The Effect of Cost Leadership Strategy on Performance of Commercial Banks in Nairobi County, Kenya	Kenya, 103 respondents	To examine how cost leadership strategy affects the performance of commercial banks, focusing on metrics such as low-interest, low operating costs, and competitive pricing.
16	2022	Adnan Ali Chaudhary, Ahsan Riaz, Nadeem Nazir, Marium Azad, Muhammad Waseem Anwar	The Cost Leadership Strategy and Its Impact on Future Performance of Non-Financial Firms; A Case Study of Pakistan	Pakistan, 111 non-financial firms	To explore the impact of the cost leadership strategy on the future performance of non-financial firms, using indicators like sales growth, return on assets, and sales to capital expenditures ratio.
17	2023	Mohd Arpi Arifin, Maheran Zakaria, Hasnun Anip Bustaman	Digital Adoption, Self-Efficacy, and Business Success – Towards Resilience and Sustainability of Micro-Entrepreneurs in the Post-Pandemic World	Malaysia, 240 micro-entrepreneurs	To assess the impact of digital adoption and self-efficacy on business success among micro-entrepreneurs, focusing on resilience and sustainability in a post-pandemic setting.
18	2023	Emmanuel Bruce, Zhao Shurong, Du Ying, Meng Yaqi, John Amoah, Sulemana	The Effect of Digital Marketing Adoption on SMEs Sustainable Growth: Empirical	Ghana, 533 SME owners/managers	To explore the relationship between digital marketing adoption and sustainable growth in Ghanaian SMEs, with a focus on behavior control,

No.	Year	Author	Title	Country & Sample	Purpose
		Bankuoru Egala	Evidence from Ghana		subjective norms, and attitudes towards digital adoption.
19	2022	Florence Mueni, Karen Angima	Effects of Digital Adoption on Performance of Insurance Companies in Kenya	Kenya, 54 insurance firms	To examine the relationship between digital adoption and performance in the insurance sector, focusing on technology's role in improving service delivery, customer satisfaction, and profit growth.
20	2023	Florentina Kurniasari, Elissa Dwi Lestari, Hendy Tannady	Pursuing Long-Term Business Performance: Investigating the Effects of Financial and Technological Factors on Digital Adoption	Indonesia, 225 SMEs in traditional markets	To identify how financial and technological factors influence digital adoption, aiming to enhance SME performance and sustainability in Indonesia's traditional markets.
21	2020	Woon Leong Lin, Nick Yip, Jo Ann Ho, Murali Sambasivan	The Adoption of Technological Innovations in a B2B Context and Its Impact on Firm Performance	Malaysia, 465 IT service companies	To analyze the role of ethical leadership in moderating the relationship between technological innovation and firm performance in the B2B sector.
22	2022	Ajayandaran Arumugam, Hamed Khazaei, Amiya Bhaumik, Thavamaran Kanesan	Analyzing the Factors Influencing Digital Technology Adoption in Manufacturing Sectors: Leadership Effectiveness as a Mediator	Malaysia, 768 E&E manufacturing firms	To explore how leadership effectiveness impacts digital technology adoption in the manufacturing sector, with a focus on the electrical and electronics industry.

Systematization of Determinants

Table 2. Determinants of Port Performance

No.	Determinant Variable	Indicator	Result	Conclusion	Previous Research
1	Networking Capability	Relationship Management, Social Capital, Stakeholder Engagement, Collaboration with Partners	Significant	Networking capabilities significantly improve operational agility and competitive advantage	[4]; [5]; [6]; [7]
2	Flexibility	Strategic Flexibility, Adaptive Resource Management, Crisis Response, Market Responsiveness	Positive Non-Significant	Flexibility supports adaptability but may not directly impact short-term performance	[8]; [9]; [10]
3	Transformational Organization	Leadership Influence, Change Management, Organizational Culture, Employee Empowerment	Significant	Transformational leadership positively affects digital adoption and adaptation to new market demands	[11]; [12] [13]
4	Cost Leadership	Operational Efficiency, Low-Cost Strategy, Cost Control, Price Competitiveness	Significant	Cost leadership effectively improves performance through operational efficiency and competitive pricing	[14]; [15]
5	Digital Adoption	Technology Use, Digital Infrastructure, Digital Skills, Implementation of New Tools	Significant	Digital adoption enhances sustainability and performance, especially in SMEs	[13]; [16]

No.	Determinant Variable	Indicator	Result	Conclusion	Previous Research
6	Ethical Leadership	Stakeholder Trust, Transparency, Ethical Standards, Influence on Adoption	Positive Significant	Ethical leadership supports digital adoption by building trust and engagement	[17]; [15]; [18]; 19

Variable Determinants

a. Networking Capability
The determinants of networking capability comprise four indicators: Relationship Management, Social Capital, Stakeholder Engagement, and Collaboration with Partners. In their research, [4] found that networking capability has a significant and positive impact, especially when assessed through the indicator of Relationship Management, which enhances operational agility. Similarly, [5] identified that Social Capital, as a measure of networking capability, yielded positive and significant outcomes, reinforcing competitive advantage in dynamic markets. [6] conducted a study focusing on Stakeholder Engagement, showing a positive and significant trend in improving organizational responsiveness to market changes. Furthermore, Al [7] examined the impact of Collaboration with Partners on overall performance, highlighting a positive influence, although the statistical significance was marginal. Collectively, these studies underscore the critical role of networking capability in fostering a competitive edge and enhancing adaptability within organizations.

b. Flexibility
The determinants of flexibility include four main indicators: Strategic Flexibility, Adaptive Resource Management, Crisis Response, and Market Responsiveness. [8] found that flexibility, particularly in the form of Strategic Flexibility, provides positive support for long-term adaptability, although its direct effect on short-term performance was non-significant. [9] observed that Adaptive Resource Management positively influences an organization's ability to adjust to environmental changes. In a study by [20], Crisis Response demonstrated a significant impact on business resilience during unexpected disruptions. Additionally, [10] examined Market Responsiveness as a flexibility indicator, finding a positive but non-significant effect on immediate performance. Collectively, these studies indicate that flexibility aids organizational adaptability, though it may not guarantee immediate performance benefits.

c. Transformational Organization
Transformational organization is determined by indicators such as Leadership Influence, Change Management, Organizational Culture, and Employee Empowerment. [11] demonstrated that leadership influence within a transformational organization has a significant effect on digital adoption and market adaptability. Similarly, [21] found that Change Management fosters positive adaptation to shifting

business demands. [12] highlighted that a supportive Organizational Culture enhances digital readiness, reinforcing adaptability in new environments. [13] noted that Employee Empowerment within transformational organizations significantly supports the transition toward innovative practices. These findings suggest that transformational organization fosters effective change management and adaptability in dynamic markets.

d. Cost Leadership

Cost Leadership is determined by indicators such as Operational Efficiency, Low-Cost Strategy, Cost Control, and Price Competitiveness. In a study by [14], Operational Efficiency within cost leadership was shown to significantly enhance business performance by minimizing costs. [15] found that implementing a Low-Cost Strategy positively impacts overall competitiveness. [22] explored the role of Cost Control in maintaining financial stability, resulting in improved operational efficiency. Additionally, [23] found that Price Competitiveness as part of a cost leadership strategy strengthens market position, significantly impacting overall performance. These studies underscore the value of cost leadership in driving competitive advantage and operational success.

e. Digital Adoption

The determinants of digital adoption include Technology Use, Digital Infrastructure, Digital Skills, and the Implementation of New Tools. [23] observed that Technology Use plays a crucial role in enhancing SME performance and sustainability. [13] found that strong Digital Infrastructure is essential for maintaining competitive positioning in the market. [16] emphasized the importance of Digital Skills in supporting digital transformation efforts, particularly within manufacturing sectors. [24] noted that the Implementation of New Tools in digital adoption significantly contributes to organizational agility and responsiveness. These findings indicate that digital adoption is essential for achieving long-term sustainability and performance in a rapidly evolving market.

f. Ethical Leadership

Ethical Leadership is assessed through Stakeholder Trust, Transparency, Ethical Standards, and Influence on Adoption. [17] demonstrated that Stakeholder Trust is integral to successful digital adoption, as trust fosters organizational support. [15] highlighted that Transparency in leadership enhances employee alignment with digital initiatives. [18] found that Ethical Standards within leadership improve organizational stability and resilience. [19] observed that ethical influence on adoption encourages engagement and commitment from employees, promoting digital transformation. Collectively, these studies underscore that ethical leadership builds trust and engagement, key drivers of successful digital adoption.

4 Discussion

Based on the 22 articles used in this research, which focus on the determinants of port performance, there are six key indicators that influence this performance: Networking Capability, Flexibility, Transformational Organization, Cost Leadership, Digital Adoption, and

Ethical Leadership. Detailed explanations for each determinant are provided in the following paragraphs.

The first determinant is Networking Capability. Effective networking capability, which includes Relationship Management, Social Capital, Stakeholder Engagement, and Collaboration with Partners, plays a critical role in enhancing operational agility and competitive advantage. According to [4], strong relationship management in networking significantly improves port agility, while [5] found that social capital positively impacts competitive advantage by fostering strong stakeholder connections. Additionally, [6] highlighted the importance of stakeholder engagement in enabling responsiveness to market demands. Al [7] also indicated that collaboration with partners enhances resource-sharing capabilities, though the effect was marginal in statistical significance. Together, these studies demonstrate that robust networking capability substantially strengthens port performance.

The second determinant is Flexibility. Indicators of flexibility include Strategic Flexibility, Adaptive Resource Management, Crisis Response, and Market Responsiveness. Research by [8] suggests that strategic flexibility positively supports adaptability in the long term, although its immediate effect on performance may be non-significant. [9] emphasize that adaptive resource management enables ports to respond effectively to environmental shifts, while [20] found that crisis response capabilities improve resilience during disruptions. [10] further supports this by indicating that market responsiveness contributes positively to long-term adaptability, even if short-term impacts on performance are limited. Flexibility, therefore, is essential for sustaining operational adaptability in dynamic market conditions.

The third determinant is Transformational Organization. This includes Leadership Influence, Change Management, Organizational Culture, and Employee Empowerment as key indicators. [11] demonstrated that transformational leadership enhances digital adoption and adaptability, while [21] found that change management within transformational organizations facilitates adaptation to business demands. Research by [12] highlighted the role of a supportive organizational culture in promoting digital readiness, which is crucial for navigating new environments. Furthermore, [13] showed that employee empowerment within transformational organizations significantly supports innovative practices. These findings underscore the importance of a transformational organizational structure in enabling efficient change management and adaptability.

The fourth determinant is Cost Leadership. Indicators of cost leadership include Operational Efficiency, Low-Cost Strategy, Cost Control, and Price Competitiveness. According to [14], operational efficiency through cost leadership significantly enhances business performance by minimizing costs, while [15] found that adopting a low-cost strategy strengthens competitiveness. [22] indicated that effective cost control maintains financial stability and improves efficiency, while [23] noted that price competitiveness reinforces a firm's position in the market. Collectively, these studies show that cost leadership is instrumental in driving performance through operational efficiency and competitive pricing strategies.

The fifth determinant is Digital Adoption. Key indicators include Technology Use, Digital Infrastructure, Digital Skills, and Implementation of New Tools. [23] highlighted that technology use significantly improves SME performance and sustainability. [13] found that robust digital infrastructure is essential for maintaining market competitiveness, while [16] emphasized the role of digital skills in supporting digital transformation efforts, especially in manufacturing. [24] demonstrated that implementing new digital tools enhances organizational agility and responsiveness. Digital adoption, therefore, is critical for achieving sustainable performance in a rapidly evolving business landscape.

The sixth determinant is Ethical Leadership. Indicators of ethical leadership include Stakeholder Trust, Transparency, Ethical Standards, and Influence on Adoption. [17] found that stakeholder trust, fostered by ethical leadership, is essential for digital adoption, as trust promotes organizational support. [15] emphasized that transparency in leadership enhances alignment with digital initiatives. According to [18], ethical standards within leadership support organizational stability, which bolsters resilience. [19] noted that ethical influence on adoption encourages engagement and commitment from employees, which is key for successful digital transformation. Collectively, these findings highlight the role of ethical leadership in building trust and engagement, which are vital for achieving successful digital adoption.

In summary, this review of 22 articles on the determinants of port performance highlights six essential indicators: Networking Capability, Flexibility, Transformational Organization, Cost Leadership, Digital Adoption, and Ethical Leadership. Networking capability drives operational agility and competitive advantage. Flexibility enhances adaptability in a changing environment. Transformational organization aids in change management and innovation. Cost leadership ensures efficient operational performance. Digital adoption is crucial for sustainable competitiveness, while ethical leadership fosters trust and engagement, supporting digital transformation. These determinants collectively underscore the multifaceted factors impacting port performance in a competitive global market.

5 Conclusion

The findings from this comprehensive review emphasize the complex and interconnected nature of determinants affecting port performance. Networking capability stands out as a crucial factor, as it not only enhances agility but also strengthens competitive advantage through relationship management, social capital, and collaboration. Similarly, flexibility in operational strategy, including crisis response and adaptive resource management, emerges as essential for ports to navigate dynamic market conditions, supporting long-term sustainability even when immediate performance benefits may be limited.

Transformational organization and cost leadership also play significant roles in driving port performance. Transformational leadership and a supportive organizational culture foster change management and digital readiness, allowing ports to adapt swiftly to technological and market shifts. Cost leadership, achieved through operational efficiency, low-cost strategy, and price competitiveness, remains essential in improving financial performance and competitiveness by minimizing costs and optimizing resource allocation.

Finally, digital adoption and ethical leadership are critical in ensuring sustainable growth and fostering trust in port operations. Digital adoption through technology use and infrastructure enhances performance and resilience, while ethical leadership strengthens organizational commitment to digital transformation by building trust and transparency. These insights reveal that port performance is driven by a multifaceted set of determinants, each contributing uniquely to overall competitiveness and adaptability, emphasizing the importance of a balanced, integrative approach to strategy in the evolving port industry landscape.

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